

SRINIVASAN ENGINEERING COLLEGE  
DEPARTMENT OF AERONAUTICAL ENGINEERING  
AE1005-WIND TUNNEL TECHNIQUES

Two Mark Questions

**UNIT-1**

1. DEFINE MACH NUMBER?

It's defined as the square root of the ratio of the inertia force of a flowing fluid to the elastic force.

2. DEFINE REYNOLDS NO?

It's defined as the ratio of an inertia force of the flowing fluid and the viscous force of the fluid

3. DEFINE EULER'S NO?

It's defined as the square root of the ratio of the inertia force of a flowing fluid to the pressure force

4. DEFINE WEBER'S NO?

It's defined as the square root of the ratio of the inertia force of a flowing fluid to surface tension force

5. DEFINE FROUDE'S NO?

It's defined as the square root of the ratio of the inertia force of a flowing fluid to the gravity force

6. DEFINE BUCKINGHAMS  $\pi$  THEOREM?

If there are  $n$  variables in a physical phenomenon and if this variables contain  $m$  fundamental dimension (M, L, T) then the variables are arranged to  $(n-m)$  dimensionless terms, each term is called  $\pi$ -term

7. WHAT IS MEANT BY SIMILARITIES?

Model and prototype have similar properties or model and prototype are similar

8. WRITE DOWN THE TYPES OF SIMILARITIES?

- Geometric similarity
- Kinematic similarity
- Dynamic similarity

## UNIT-2

### 1. WHAT ARE THE CLASSIFICATIONS OF WIND TUNNEL?

- Low speed wind tunnel,
- High speed wind tunnel,
- Special type tunnel.

### 2. WHAT IS FUNCTION OF EFFUSER?

It converts available pressure energy into kinetic energy and its located upstream of the test section.

### 3. WHAT IS FUNCTION OF DIFFUSER?

It converts the kinetic energy to pressure energy and it's downstream of the test section.

### 4. WHAT IS BREATHER?

It is attached with an one way valve so that it take the air and by propeller suction, flow is maintained inside the return type.

### 5. WHAT ARE THE MERITS AND DEMERITS OF OPEN CIRCUIT?

- Construction cost less,
- It no surging problem is open to the free atm.

#### DEMERITS.

- Tunnels much noisy,
- Make cost environment problem.

### 6. DEFINE ENERGY RATIO.

It is defined as the ratio between the total kinetic energy of the flow to the energy loss.

$$ER = 1/K_0$$

### 7. WHAT ARE THE ADVANTAGES OF BLOW DOWN TYPE WIND TUNNEL?

- This is the simplest among the supersonic tunnel and most economic to build.

- Constant blowing pressure can be maintained for considerable running by throttle valve.

#### 8. WHAT ARE THE APPLICATIONS OF VERTICAL WIND TUNNEL?

- It is used to study the spinning motion of the aircraft,
- Ejection of pilots from seats,
- Parachute flying,
- Helicopter operation.

#### 9. WHAT ARE THE LOSSES IN SUPERSONIC TUNNEL?

- ✓ Friction losses,
- ✓ Expansion losses,
- ✓ Losses in the contraction cone and test section,
- ✓ Losses in guide vanes,
- ✓ Losses in cooling system.

### UNIT – 3.

#### 1. WHAT ARE THE TYPES OF FLOW ANGLE MEASUREMENTS?

- Sphere type yaw meter,
- Claw type yaw meter.

#### 2. WHAT ARE THE TURBULENCE MEASUREMENTS?

- Turbulence sphere,
- Pressure sphere,
- Hot wire anemometer.

#### 3. WHAT ARE THE METHODS TO REDUCE TURBULENCE INSIDE W/T.

- Using max. no of fan blades,
- Using a very long and gradual nacelle,
- Anti swirl vanes,
- Providing max. Possible distance between propellers and test section.

#### 4. PRINCIPLE OF HOT WIRE ANEMOMETER.

The rate of heat from an electrical heated wire and placed in an airstream is proportional to the velocity.

### UNIT-4

#### 1. DEFINE WIND TUNNEL BALANCE?

Wind tunnel balance is a device to measure the actual forces & moments acting on a model placed in the test section stream

2. WHAT ARE THE CLASSIFICATIONS OF WIND TUNNEL BALANCE?

- Wire type balance
- Strut type balance
- Platform type balance
- Yoke type balance
- Strain gauge type balance

3. WHAT DO YOU MEAN BY WIRE BALANCE?

In wire type wind tunnel balances only wires are used to support the model. All the load components are transmitted to the measuring device by these wires.

4. WHAT ARE THE CLASSIFICATIONS OF STRUT TYPE BALANCES?

- Yoke type
- Platform type
- Pyramid type

5. WHAT ARE THE TYPES OF STRAIN GAUGE BALANCE?

- Internal balance
- Semi internal balance
- External balance

6. WHAT IS THE PRINCIPLE OF LIQUID MANOMETER?

The principle is that the pressure is balanced by the weight of a liquid column.

7. WHAT ARE THE TYPES OF BAROMETERS?

- Syphon barometer
- Fortin barometer
- Aneroid barometer

8. GIVE SOME DISADVANTAGES OF DIAL TYPE PRESSURE GAUGE?

- They must be calibrated periodically to ensure that they continue to read correctly
- The manometers are less expensive when there is a large number of pressures to be read
- Like manometers, they cannot be easily read electronically

9. WHAT ARE THE TYPES OF PRESSURE TRANSDUCERS?

They are classified as mechanical, electrical & optical type

10. LIST OUT SOME ADVANTAGES OF PRESSURE TRANSDUCERS?

- They provide signal proportional to the applied pressure which can be automatically recorded by acquisition system
- They are relatively low volume devices & consequently respond more rapidly to pressure changes
- They are small enough to be mounted inside wind tunnel models

11. STATE THE PRINCIPLE OF LDA?

The principle is that a moving particle illuminated by a light beam scatters light at a frequency different from that of the original beam. This difference in frequency is known as Doppler shift & it's proportional to the velocity of the particle.

12. WHAT ARE THE SCATTERING SUBSTANCES USED FOR LDA?

- Micro polythene spheres
  - Diluted milk droplets
  - Diluted smoke particles
  - Aerosol
  - Fine alumina powder
13. WHAT ARE THE ADVANTAGES OF LDA?
- It has high frequency response
  - It has negligible probe interference
  - It is applicable to a wide range of applications
  - The measurement with LDA is absolute, linear with velocity & require no pre-calibration
14. GIVE SHORT NOTES ON REFERENCE BEAM SYSTEM?
- In reference beam system the scattered beam of light is optically mixed with original beam & the difference is obtained as the Doppler shift in frequency. This technique is known as heterodyning & it's the characteristic of a photo multiplier.
15. WHAT IS THE ADVANTAGE OF VORTEX SHEDDING TECHNIQUE?
- It is capable of measuring low speeds of air which cannot be measured accurately with a conventional manometer.

## UNIT-5

### 1. DEFINE PATHLINE?

The path of a point or particle convected with the flow is called a path line. If we could release a tracer particle at any selected point and record its subsequent path, this would be a path line.

### 2. DEFINE STREAKLINE?

It is a curve which represents the instantaneous motion of the fluid particle from the given point.

### 3. DEFINE STREAMLINE?

A streamline through a point at an instant in time is the line whose tangent is the velocity at that point and that follows a path through the fluid such that the tangent at every point is the local instantaneous velocity.

### 4. DEFINE TIMELINE?

A timeline is generated by simultaneously emitting a short burst of tracers along a line perpendicular to the local flow. This marks a line of elements that are in a straight line at the initial time.

### 5. HOW CAN WE CLASSIFY FLOW VISUALISATION?

The flow visualization can be broadly classified into two, they are

- ✓ surface flow visualization
- ✓ flow field visualization

## **6. WHAT ARE THE KEY ASPECTS OF SURFACE FLOW THAT CAN BE INVESTIGATED FROM SURFACE FLOW VISUALISATION?**

Key aspects of surface flows that may be investigated using visualization techniques include

- ✓ Stagnation point location
- ✓ Separation lines
- ✓ Location of boundary layer transition
- ✓ Characteristic unsteadiness
- ✓ Extent of separation zones
- ✓ Types of critical points

## **7. WHAT ARE THE REQUIREMENTS OF TUFTS?**

The Tufts must be of light, flexible material that will align itself with the local surface flow as a result of direct of direct aerodynamic force.

## **8. WHAT ARE THE MATERIALS USED FOR MAKING TUFTS?**

The most commonly used material is light yarn with weights and lengths chosen according to model size and test speed.

## **9. WHAT ARE THE MATERIALS USED FOR MAKING MINITUFTS?**

The tuft material is monofilament nylon that has been treated with a fluorescent dye.

## **10. WHAT ARE THE ADVANTAGES OF USING TUFTS?**

- ✓ Easily producible
- ✓ Once the tufts are installed the model can be repositioned and indications studied visually & photographed for as long as desired.

## **11. WHAT ARE THE METHODS OF OPTICAL FLOW VISUALISATION?**

- ✓ Shadow graph
- ✓ Schlieren technique
- ✓ Interferometer

## **12. WHAT ARE THE APPLICATION OF SMOKE VISUALISATION?**

- Flow over an aerofoil
- Study vortex motion

## **13. WHAT ARE THE ADVANTAGES OF OPTICAL TECHNIQUES?**

- Non intrusive
- Avoiding the formation of unwanted shockwaves
- Avoid problems associated with the introduction of foreign particles

## **14. WHAT IS THE FUNDAMENTAL PRINCIPLE OF THE INTERFEROMETER?**

From corpuscular properties of light, we know that when light travels through a gas the velocity of propagation is affected by the physical properties of the gas.

$$C=f\lambda$$

## **15. WHAT IS THE FUNDAMENTAL PRINCIPLE OF SCHLIEREN TECHNIQUE?**

The speed of a wave front of light varies inversely with the index of refraction of the medium through which the light travels.

### **PART -B**

#### **UNIT I**

1. Derive on the basis of dimensional analysis suitable parameters to present the thrust developed by a propeller. Assume that the thrust depends on the angular velocity, speed of advance, diameter dynamic viscosity, mass density, and elasticity of the fluid medium which can be denoted by the speed of sound in the medium?
2. The pressure difference in a pipe of diameter and length due to viscous flow depends on the velocity viscosity and density .using Buckingham theorem obtains an expression
3. Explain Buckingham pi theorem with example
4. Briefly explain the types non dimensionless number

#### **UNIT II**

1. Derive the pressure drop coefficient for diffuser and effuse and draw the corresponding curve?
2. Explain the operation, merits, demerits and application of hypersonic wind tunnel and also briefly explain the losses in subsonic wind tunnel.
3. Explain the operation, merits, demerits and application of supersonic and aero acoustic tunnel?
4. Explain the operation, merits, demerits and application of any three special purpose wind tunnels
5. Briefly explain the special purpose hypersonic wind tunnel

#### **UNIT III**

1. Derive the equation for test section speed in low speed wind tunnel and draw the corresponding curve
2. Explain types of flow angularity measurement.
3. Explain types of turbulence measurement in wind tunnel?

4. Explain the operation Gun tunnel and Shock tunnel
5. With a neat illustration explain the objective of calibration of a wind tunnel. In what way the calibration procedure for a supersonic tunnel different from that of a subsonic wind tunnel?

#### **UNIT IV**

1. How to measure velocity of flow using LDA technique
2. Explain wire type balance with neat sketch and mention the merits and demerits
3. Explain strut type balance with neat sketch and mention the merits and demerits
4. Explain six component balance with neat sketch
5. Mention the features and characteristics of wind tunnel balance

#### **UNIT V**

1. Explain the classification of flow visualization techniques
2. Explain the optical flow visualization techniques
3. Explain surface flow visualization technique
4. Explain the data flow visualization techniques